ATTACHMENT - REMARKS

By this Amendment, dependent claim 42 has been amended to correct self-evident errors noted by the examiner. It is submitted that the present application is in condition for allowance for the following reasons.

Initially in the *Claim Objections* section of the DETAILED ACTION, the examiner noted three minor and self-evident errors needing correction in dependent claim 42. By this Amendment, the noted corrections have been made.

In the following *Claim Rejections - 35 USC § 103* section, independent claims 2, 19 and 20 and dependent claims 3-13, 15-18, 21-26 and 42 were all rejected under 35 USC § 103 as being obvious over the principal Warner patent (USP 5,957,969, hereafter "Warner") in view of the newly cited Bouisse patent (USPA 2002/0145483, hereafter "Bouisse") and the previously cited but not applied Mody patent (USP 7,226,446, hereafter "Mody"). However, for the following reasons, it is submitted that these claims are all allowable over this combination of references.

Initially, it will be appreciated that independent claims 2, 19 and 20 all require the use of: (i) a stable source, which permits accurate detection of magnitude and phase; and (ii) a local oscillator having a frequency different from the source to aid detection of the magnitude and phase of signals with a frequency in the range 5-60 GHz.

Before discussing the art rejection itself, it is initially noted that in the *Response to Arguments* section of the Action, the examiner has stated that:

> applicant's specification discloses that it is preferred to have a stable source of microwave radiation, but that any source of microwave radiation can be used (pg. 30, ll. 19-26). [Emphasis added, see page 11, middle of the 3rd ¶.]

However, it will firstly be noted that the examiner's statement mischaracterizes what was stated in the specification. In particular, the present disclosure at the noted location recites that "different types of microwave sources … or different frequency ranges could be used" (see 30/22-24). However, this disclosure is not an assertion that any and all types of microwave sources (and/or frequency ranges) are possible, with no other qualifications. Rather, it shows that there is a variety of sources and ranges which can be suitable if otherwise consistent with the invention as subsequently disclosed.

Subsequently, and consistent with the preceding recitation, it is then disclosed in the specification that "it is highly preferable that the source of microwave radiation is stable (i.e., provides a stable output)" (emphasis added, see 31/10-11). Thus, in such a preferred embodiment, any of the suitable microwave sources would also be required to have this additional feature of a stable output - for the noted advantages as also disclosed.

The above statement of the examiner thus makes it seem that the limitation of a "stable output" in the claims is being ignored, because the examiner considers that applicant's disclosure that "any source" (whether stable or not, according to the examiner's interpretation) controls the claimed feature of a source having a "stable output", so that this limitation does not restrict the claimed invention. This analysis of how to interpret the recited passage would thus be improper on its face, because that is not what was stated in the specification as noted above. In addition, applicant is entitled to claim a preferred embodiment and the features thereof in the claims (in a dependent or independent claim!); and, as made plain in MPEP § 2143.03, "All words in a claim must be considered in judging the patentability of that claim against the prior art".

Therefore, it is clear that the “stable output” limitation of the independent claims must be considered in a proper prior art rejection.

Turning then to the art rejection itself, it will be appreciated that Warner discloses a microwave ablation catheter system. A tuner is provided to match the impedance of a power supply to the impedance of a microwave transmission line that carries energy to a catheter. The power supply generates a microwave signal with a frequency between 800 MHz and 3 GHz (see column 4, lines 45 - 47). Warner proposes using a conventional magnetron, of the type commonly used in microwave ovens, as the microwave power source (see column 4, lines 54 - 55). To tune the apparatus, Warner specifies using a controller to adjust the tuning mechanism on the basis of a signal from a reflected power monitor that is indicative of the magnitude of the reflected power.

The Examiner correctly recognizes that Warner does not teach detecting the phase of the reflected power, using a local oscillator, and setting the output frequency in the range 5-60 GHz. As set out in applicant’s previous response, the present invention also requires the source to output a signal with a <u>stable output frequency</u>. The Examiner submits that the use of a magnetron does not preclude the device from having a stable frequency, but this assertion goes against convention wisdom or the common knowledge of those of ordinary skill in the art that a magnetron's output is <u>intrinsically</u> unstable. It is well known that the output frequency of a magnetron drifts due to: (i) thermal drift, where the physical size of the resonant cavity changes with temperature; (ii) frequency pushing, where variations in the power supply voltage change the amount of power supplied to the magnetron; and (iii) frequency pulling, where variations in load impedance affect the extent of coupling between the magnetron

and load. These parameters are often included in magnetron specifications in view of the intrinsic instability, as also appreciated by those of ordinary skill.

As indicated in the specification of the present invention, a stable output frequency is important because an unstable output frequency disrupts (i.e., makes virtually impossible) accurate phase measurements. Thus, this is an important limitation for the claimed invention (which can not be ignored as noted above).

Although column 4, lines 55 to 56 of Warner suggest that 'any suitable microwave power source' can be used, there is no indication in Warner that a stable source is advantageous or desirous. As such, this general statement in Warner cannot be said to teach to those of ordinary skill that the use of a microwave source with a stable output frequency as claimed and for the advantages as noted would be desired.

Furthermore, independent claim 2 recites tissue ablation apparatus in which both the magnitude and phase of reflected radiation is measured by incorporating a local oscillator into the apparatus (magnitude and phase are measured by comparing the reflected radiation with the signal from the local oscillator). As mentioned above, these two features are related: having a stable source makes accurate phase detection possible. The arrangement in Warner is impractical for detecting both magnitude and phase with a reflected signal because the source of microwave radiation is too unstable. And one advantage of detecting both magnitude and phase is that it allows a complex impedance for the impedance adjuster to be determined.

Independent claim 2 specifies further that the output frequency from the microwave radiation source is in the range 5 to 60 GHz, which lies above the range proposed in Warner. Using higher frequencies in combination with the accurate

detection of magnitude and phase enables the claimed apparatus of the present invention to react to variations in impedance at the probe tip more rapidly, as discussed in more detail in applicant's response to the previous Office Action.

The examiner acknowledges in the Office Action that Warner fails to disclose detecting the phase of the reflected microwave radiation, or the use of a local oscillator. It is alleged then by the examiner in the Action that it would have been obvious in light of Bouisse to include these features in the apparatus described in Warner. However, no separate local oscillator is included in the impedance matching circuit described in Bouisse. Instead, the magnitude and phase of the reflected signal are determined using a Voltage Standing Wave Ratio (VSWR) detection element (50 in figure 1). In the VSWR element, the magnitude and phase of the reflected signal are separately compared to the magnitude and phase of the transmitted signal in a magnitude comparator (60 in figure 1) and a phase comparator (57 in figure 1). Paragraph [0024] of Bouisse confirms that the transmitted and reflected signals have the same frequency as each other, enabling the phase difference to be determined from the multiple of the two signals. The magnitude of the reflected signal relative to the transmitted signal is separately determined in a magnitude comparator (60 in figure 1).

In contrast, present independent claim 2 recites an apparatus having a local oscillator that produces a signal having a frequency different from the frequency of the microwave radiation. This frequency difference between the local oscillator signal and the reflected signal enables both the magnitude and phase of the reflected signal to be determined simultaneously. The importance of providing a different frequency is discussed on page 25, lines 17 to 27 of the description. A local oscillator signal of a

different frequency to the microwave radiation could not be incorporated into the VSWR detection element of Bouisse, as it would not be possible to generate a standing wave from two signals with different frequencies.

In addition, the impedance matching circuit described in Bouisse is designed for use with an RF signal with a frequency of between 900 MHz and 1.9 GHz. In contrast, present independent claim 2 recites a source of microwave radiation having a stable output frequency in the range of 5 to 60 GHz. As the difference in frequency is greater than a factor of two, it is not obvious to those of ordinary skill that the circuit would work correctly at the higher frequencies recited in claim 2.

Finally, the impedance matching circuit disclosed in Bouisse is not suitable for use with a conventional magnetron, which is the favored radiation source disclosed in Warner. A conventional magnetron outputs microwave radiation through a waveguide. The electrical circuit shown in figure 1 of Bouisse, which consists of a series of capacitors and inductors, and is thus not suitable for inclusion in a waveguide. As such, it is submitted that the tuner and the teachings disclosed in Bouisse cannot be used without undue experimentation in the apparatus described in Warner and therefore the proposed combination would not be obvious.

Mody discloses ablating tissue using microwave radiation at a frequency between 400 MHz and 6 GHz. However, there is no teaching or suggestion that the impedance matching mechanisms of either Warner or Bouisse would be capable of operating even in the small overlap between Mody's frequency range and the range of 5 GHz to 60 GHz recited in independent claim 2. In fact, the present invention makes use of the local oscillator to achieve magnitude and phase detection in the frequency range

5-60 GHz. This is not disclosed in any of the cited documents.

Mody further teaches that it is advantageous to use a conventional magnetron as the source of microwave radiation. As previously discussed, those of ordinary skill would know that a magnetron is not a stable source of microwave radiation as required by independent claim 2.

The present application thus discloses an improved tissue ablation apparatus not shown or made obvious by the art. The improvement is achieved by providing both a stable microwave radiation source and magnitude and phase detection and also by incorporating the additional understanding that using such a detection system with higher treatment frequencies results in an apparatus that is superior in accuracy and reaction speed to known devices. Since none of the cited documents suggest moving towards or achieving this combination; independent claim 2 thus defines an invention that is novel and non-obvious over the cited combination of references.

Therefore, for all of the foregoing reasons, it is submitted that independent claim 2 is now allowable. In addition, as independent claims 19 and 20 also include the same limitations of claim 2 as noted above, it is submitted that independent claims 19 and 20 are likewise allowable. Finally, as the remaining dependent claims, claims 3-13, 15-18, 21-26 and 42 each depend from a respective allowable independent claim, it is submitted that these dependent claims are allowable at least for the same reason as the independent claim from which they depend.

In the Action, dependent claims 40-41 were separately rejected under 35 USC § 103 as being obvious over Warner in view of Bouisse patent and Mody, and additionally in view of the Driscoll patent (USP 5,519,359). However, as noted above, it is

submitted that these dependent claims are allowable at least for the same reasons that independent claim 2 from which they depend is allowable.

For all of the foregoing reasons, it is submitted that the present application is in condition for allowance and such action is solicited.

Respectfully submitted,

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